

LAWRENCE BERKELEY NATIONAL LABORATORY

# OPEN HOUSE



**CIRQUE  
DES SCIENCES**  
*THE GREATEST SCIENCE ON EARTH!*



# GREETINGS FROM BERKELEY LAB DIRECTOR PAUL ALIVISATOS



Welcome to Berkeley Lab's Open House. If you have questions about the world around you and you love to solve puzzles and figure things out, then you have the heart of a scientist, and you are very much like the people who work here at Berkeley Lab. We ask questions, figure out possible solutions, and test our ideas in order to solve problems — from how to save energy to how the universe began; from building the smallest machines to building large scientific tools; from breaking down plants to make fuel to breaking open the genetic code to cure cancer. We at Berkeley Lab welcome you today to join us in discovering the secrets of our world and how to meet some of the biggest challenges that humans have ever faced. We encourage you to ask questions and look for answers — today and every day!

## GREEN ZONE

*See map on back page for location of exhibits and activities.*

### UNDER THE BIG TOP

#### Experience Science in 3D

Watch these 3D computer simulations:

- Buoyant Burning Bubble in Type 1a Supernovae
- Global Cloud Resolving Models
- Turbulent Jets With Off-Source Heating
- A New Perspective on Supernova Explosions
- Void Space of Porous Materials Used in Energy-Related Applications
- Interior of 3D Micro-CT From Iron-Sand Composite

Video takes about 10 minutes to view.

#### Restoring Our Wetlands: The Microbial Balancing Act

Learn the roles microbial communities play in restored wetlands, and the communities' impact on long-term carbon sequestration. A piece of restored wetlands from the Delta will be on display, including plants, muck and all, offering visitors a chance to peer into the life it harbors and understand the intricate relationships of the niche occupants with hands-on activities.

#### Plants to Biofuels: Science at the Joint BioEnergy Institute

Various non-food crop plants can provide the ideal renewable source for biofuel production. To reach this goal, researchers are focusing on understanding plant and biomass composition, deconstructing the plants to sugars, and developing microbes that can convert the sugars to fuels. Learn how this conversion will take place.

#### Batteries and Fuel Cells for a Clean Energy Future

Want to drive an all-electric car? Learn about energy conversion and storage technologies that could support production of electricity from renewable sources and lead to better electric vehicles.

#### Cirque de Radiation Nucléaire

Radioactivity is everywhere. It is a natural part of our food and soil, and it also comes from the sun and outer space. We will demonstrate how scientists "see" these different types of radiation. Operate a Cosmic Ray detector, which measures stardust. Use a Geiger counter to see which items are radioactive. Operate our gamma detector, which found a miniscule amount of radiation that arrived in the Bay Area from the recent earthquake in Japan.

## **Crusty Biology and Climate Change: Studying Desert Crusts to Learn About Extreme Biology**

See a biological soil crust sample come to life and begin to respire. A microscope will reveal what happens when a desert crust gets rained on, and a respirometer will allow the audience to watch the microbes' reaction to environmental conditions. See with your own eyes what has remained a mystery until very recently.

## **Surface Tension: Kitchen Sink Nanoscience**

How can objects denser than water float? The trick is in water's stickiness to itself — the water makes objects float that should otherwise sink. Together we'll experiment with this effect, called "surface tension," and learn how you're doing nanoscience every time you grab the soap!

## **House Doctors**

Check out the "Tell-Tale House," which shows where the air flows inside homes. Learn the carbon footprint of day-to-day items. Watch a demonstration of a range hood. See how hot things are through a thermal camera. Find out the best and worst uses of duct tape, and experiment with diagnostic tools on a flow hood, duct blaster, and a blower door.

## **Tabletop Particle Accelerator: Surfin' Electrons on a Laser-Plasma Wave**

Laser pulses lasting one quadrillionth of a second and with peak power of trillions of watts can be used to make waves in ionized gases (plasma waves). Similar to surfers on ocean waves, particles can be accelerated on plasma waves. How does it work and how can we generate trillion-watt pulses when the output power of the machine is equivalent to one of your light bulbs at home? Come and behold movies and demonstrations that will bring lasers, waves, and plasmas to life.

## **CIRCUS GROUNDS**

### **Particle and Nuclear Jugglers at the Cirque Subatomique**

See how we study the universe at the largest and smallest scales — and learn about the instruments that make it happen. Guess the mass of the particle that lets mass exist, touch the thinnest subatomic-particle detector of them all, and learn what the baby universe was like at the age of one-millionth of a second. See the most precise gamma ray detector ever built — so amazing it became a movie star. You can even make a train float above its track — not with superhero powers, but with science.

### **U.S. Department of Energy Berkeley Site Office**

Energy saving tips and resources from the DOE Office of Energy Efficiency and Renewable Energy are available here, as well as information on the DOE Office of Science — the single largest supporter of basic research in the physical sciences in the United States.

### **Molecular Acrobatics: Electron Juggling & Chemistry Light Show**

In the microscopic universe, tiny particles are constantly juggled around inside atoms and molecules by light and particle impact. Learn how the everlasting motion of particles on strange pathways can ultimately lead to useful materials for everyday life. Some of these materials then show colorful and glowing properties in chemical reactions. Experiment with salts and minerals while experiencing the color and brightness of chemistry.

### **Journey to the Center of the Earth**

Make the perilous descent into the unknown. You'll pioneer with us from the far reaches of our atmosphere to model climate change, descend through the surface of land and sea where mighty microbes feast on nuclear contamination and oil spills, shake through the very crust of the earth to generate energy and store carbon, and peer in awe to the very depths of Hawaiian volcanoes. Check out videos, an earthquake shake table, and test your skill at the "Store the CO<sub>2</sub>" game.



## **EngineerRINGMASTERS: Building Instruments for Science**

In the field of Big Science here at Berkeley Lab, Engineering is Ring Master! How do we make things work? Who builds and designs the pieces used on the experiments at the Lab? What challenges must be overcome? The Engineering division is here to answer these questions and to give a peek into the world that makes things go. See how high-voltage accelerators get their power and how we watch radical explosions, as well as hands-on magnets in action, levitating trains, and more.

## **Sustainable Energy Technologies**

Experience how cool roofs and cool pavements can cool your house, your city, and our planet. See demonstrations of new cool-colored roofing products as well as cool pavement and roof samples. Watch electricity vampires in action and test out home appliances to see how much power they are using — when you thought they were off! Check out demand-response technologies used by utility companies to initiate electric grid reliability and price signals, which can be sent via the Internet, as well as steps consumers can take to prevent blackouts and brownouts and reduce energy costs.

## **The Science of Safety**

Create a pretend science experiment and learn the importance of protective equipment like gloves and safety glasses. Use a sound level meter to discover how loud everyday items are, such as toys, appliances and a child's cry. You might be surprised! Learn about safe use of handheld lasers and how they are affecting air travel.

## **The Magical World of Ergonomics**

Test your strength and determine safe ways to lift and carry objects, as well as learn the "magic balloon trick" of good versus bad posture.

## **Moving Lab Technologies to the Marketplace**

Since 1990, Berkeley Lab technology has formed the basis for over 30 start-ups, creating over 2,000 new jobs in these companies alone. Check out a map of the California start-up companies based on Lab discoveries. One such business is the PolyPlus Battery Company, which makes ultra-lightweight lithium/AIR batteries. These batteries rival the energy of gasoline, far exceed the life of lithium ion batteries, and are nontoxic and environmentally benign. Check out one of these batteries, which are being developed for consumer electronics and electric vehicles.

## **Amazing Careers Under the Big Top**

Why work at Berkeley Lab? There are plenty of reasons. Learn from our human resource specialists about the benefits, types of positions, and application process at the Lab. Hear testimonials from current employees on the advantages of working here, as well as information for international researchers and scholars.

## **The Fruit Fly Circus**

Come one, come all, to see the amazing fruit flies! Have fun using dissecting microscopes, and discover all the different features of normal and mutant fruit flies — the *Drosophila melanogaster* — and find out what they teach us about the genetics of life.

## **The Smallest Science on Earth!**

What's new, CO<sub>2</sub>? Try out an invisible color changer that shows how chemical reactions work. Watch a video on photosynthesis and talk to a researcher on how scientists are trying to replicate this amazing feat of nature to help generate new energy sources. Help build a giant, 15-foot tall nanotube using balloons.

## **Ask a Scientist**

Stop by to talk with Lab scientists about a range of topics, from high-performance computing to energy efficiency to the mysteries of neutrinos.

## Welcome to X-Ray Science Under the Big Top

It may not be a three-ring circus, but it takes two rings — a booster and storage ring — and a linear accelerator to generate intense beams of x-rays for research in energy, environment, materials, biology, physics, and chemistry. Each year more than 2,000 researchers from all over the world conduct experiments at the Advanced Light Source to develop drugs that work, more efficient computer chips, take the energy from sunlight and convert it to electricity, and much more. Scientists and staff will be on hand to answer your questions as you take a self-guided tour around the ALS. Open from 10:30 a.m. to 2:30 p.m.

## Accelerator Magnet Petting Zoo

Particle accelerators like the Advanced Light Source use electromagnets to keep the particle beams on track. They are usually hidden behind shielding walls or in tunnels, but we have let a few out for you to enjoy. The magnets are not connected to a power supply, so you are welcome to pet them. We also have a few permanent magnets with their magnetic field intact, so observe the warning signs.

## The a-MAZE-ing Cosmic Sideshow (Bldg. 2)

What is dark matter? Where does the matter we are made of come from? What happened after the Big Bang? When and how did matter separate from anti-matter? When did atoms form? Learn about these fascinating subjects and others while finding your way through a MAZE of facts around cosmology. Just watch out for the black hole — we know where some of them are, but when you explore the universe, you never know what you'll find!

## Journey to the Bottom of the Earth (Bldg. 2)

Meet scientists who stood at the South Pole and see the equipment they installed there. They built the world's largest detector of almost-indetectable particles: neutrinos. How indetectable? Trillions of neutrinos are going through you right now and you aren't even aware of it! A cubic kilometer of clear, pure ice turns out to be a great place to see something almost as invisible as a ghost.

## Guest House

Scientific experiments don't end when the workday does. Researchers often toil into the wee hours of the morning to make sure tests run properly. To help make visiting scientists more comfortable, the Guest House was constructed as a home away from home. Take a tour of this science hotel and purchase snacks while you're there.

## UC Police Department Alameda County Fire Department First Aid

Meet some of our area's first responders...officers from the UC Berkeley Police Department and Alameda County firefighters. First-aid personnel will also be on hand.



## Believe It or Not: Supercomputing Odditorium (inside Bldg. 50)

Come one, come all — see the science that is too big, too small, and too dangerous for the laboratory! From microscopic carbon dioxide trapping bugs to the uber energy-efficient supercomputer made of smartphone chips, this science is too extreme for ordinary laptops. Marvel at the monstrous 100 Gbps science network — it is 20,000 times faster than most home broadband connections.

### Lectures

Visit the Building 50 auditorium to hear scientists talk about their research in easy-to-understand language. Researchers will answer questions after their talks, if time allows.

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|------------|---|
| 10:30 a.m. | Peter Nugent: The Supernova in the Pinwheel Galaxy      |
| 11 a.m.    | Blake Simmons: Creating Biofuels                        |
| 11:30 a.m. | Alice Muller-Egan: Highlights of the Nano Film Festival |
| 12:30 p.m. | Kathy Yelick: Saving the World With Computing           |
| 1 p.m.     | Carl Haber: Reconstructing Ancient Sounds               |
| 1:30 p.m.  | Andre Anders: The Promise of Plasma Beam Technology     |
| 2 p.m.     | Melissa Lunden: Coping With Indoor Air Pollution        |
| 2:30 p.m.  | Prabhat: Scientific Visualization 101                   |

## Lights! Power! Action! The Facilities Story

Scientific discoveries can't happen without a strong foundation, and that's what the Lab's Facilities Division provides. Check out the group's "Four Pillars" pavilion, which showcases their disciplines, services and people. Sideshows will feature crafts and tools — such as our 3-D printer and new "green" hand wash stations — outreach programs, and a 3-D model of the entire Lab site. A Ben and Jerry's ice cream truck will sell refreshments. Hands-on activity areas include "energy cycles" that can be ridden to generate power, and a visit from our special "green" landscapers — our goats! Also on display will be large construction vehicles and equipment, views of the Bevatron demolition site, electric "gem" carts, and a DJ providing fun music.

### Magical Lab Bus Tour

Come one, come all, for a 15-minute bus tour of Berkeley Lab's campus and learn more about the research our scientists juggle everyday! Buses depart about every five minutes. Tickets are required and are available at the Information Booth in the main exhibit area (Green Zone). Get them while they last!



## Family Adventure Zone

Step right up and into the shoes of a researcher to explore bubbling concoctions of various states of matter. Harness the magic of science to blow up a balloon using only your fingers. Use the newest "cool roof" technology to make secret messages that only you — and high-tech detectors — can see. Find out more about how you, your school, or any group can stay connected with Berkeley Lab throughout the year.

## Wizard's Lab

A ball floats and spins in midair, fingers pass through a seemingly solid object, words whispered into a metal can are heard over 10 feet away — these are just a few of the weird, wondrous, hands-on exhibits found in the Wizard's Lab! As "science wizards," kids explore the almost magical properties of matter and energy, participate in high-voltage experiments, and figure out how things really work in the fun-, fact-, and phenomenon-filled world of physics.

## PERFORMANCE STAGE

### Featuring Berkeley Lab Employees

10:30 to 11:15 a.m.	Berkeley Lab Ukulele Club
11:15 to 11:45 a.m.	Freddie Crenshaw (singer)
Noon to 12:05 p.m.	Address by Lab Director Paul Alivisatos
12:15 to 12:45 p.m.	Stepping Performance
12:45 to 1:30 p.m.	Johnny Hi-Fi Rock & Roll Band
1:45 to 2:30 p.m.	Berkeley Lab Rhythm & Blues Band





